IBM Flex System NAS Solutions
IBM Redbooks Solution Guide

With the introduction of the Microsoft Windows Storage Server 2012 offering via the IBM® Reseller Option Kit (ROK) program, clients can now get customized unified storage solutions which precisely match their specific needs. Combined with the IBM Flex System™ compute nodes and preinstalled by an IBM Business Partner, Windows Storage Server delivers enterprise-class storage management technology in an affordable, all-in-one solution. It is a great choice for your business regardless of whether you are a first-time user of network-attached storage (NAS) or you are deploying advanced storage solutions.This IBM Redbooks® Solution Guide provides an overview of IBM Flex System and Microsoft Windows Storage Server 2012, and describes several typical implementation scenarios.

The following figure shows the IBM Flex System NAS solution components.

Figure 1. IBM Flex System NAS solution components

Did you know?

IBM Flex System offers intelligent workload deployment and management for maximum business agility. It delivers high performance, complete with integrated servers, storage, and networking, for multi-chassis management in data center environments. Its flexible design can meet the needs of varying workloads with independently scalable IT resource pools for higher utilization and lower cost per workload. While increased security and resiliency protect vital information and promote maximum uptime, the integrated, easy-to-use management reduces setup time and complexity, for a quicker path to return on investment.

Windows Storage Server 2012 based unified storage with the flexible choice of storage protocols (iSCSI, SMB, NFS) can provide required performance levels for the most demanding server applications while significantly lowering deployment and support costs. Unlike Windows Server 2012, Storage Server does not require client access licenses and does provide a virtually unlimited number of supported clients for storage-sharing purposes.

Solution summary

In this guide, we describe two deployment scenarios for the IBM Flex System NAS solution with Windows Storage Server 2012:

- Unified storage server
- Highly available unified NAS gateway

The following table summarizes the characteristics of these two solutions.

Table 1. Solution characteristics

Feature	Unified storage server	Highly available unified NAS gateway
Storage protocols	iSCSI, SMB, NFS	iSCSI, SMB, NFS
Client applications	Yes	Yes
Server applications	Yes	Yes
Application server availability	Yes	Yes
Storage server availability	No	Yes
Storage implementation	IBM Flex System Storage Expansion Node	IBM Flex System V7000 Storage Node
Maximum number of drives	12	240
Data deduplication	Yes	Yes
Snapshots	Yes	Yes
Advanced data security	Yes	Yes
Centralized management	Yes	Yes
Infrastructure services	Yes	Yes

Business value

With enhanced integration and manageability features, IBM Flex System NAS solutions with Microsoft Windows Storage Server 2012 reduce the time spent on IT administration, helping your business to:

- Consolidate file-sharing resources on Windows Storage Server in mixed, heterogeneous computing environments

- Speed access to data across your entire network infrastructure, while improving control of files and compliance via a single management interface

- Take advantage of simplicity, ease of use, and low-cost scalability to leverage your organization's current IT skills to efficiently support a growing user base

Key features and benefits provided by IBM Flex System running Windows Storage Server 2012 include:

- An affordable and reliable unified network-attached and block-level storage solution

- A dedicated and optimized file and print server

  - Microsoft Windows Storage Server 2012 has all function unrelated to file serving removed (while keeping essential infrastructure services for easier deployments), helping increase reliability and lower the overhead on the server's processor.

- Industry standard components

  - Reliable storage servers are built on proven IBM x86 hardware platform.

- Flexible installation and deployment

  - IBM's diverse portfolio of Flex System components and options enables clients to finely tune their server, storage, and networking to meet cost and performance needs.

- Easy integration into your existing IT infrastructures

  - Files can be shared across heterogeneous file system environments and different operating system platforms through the integration of SMB and NFS protocols.

- Easy to use and manage

  - IBM Flex System Manager™ provides centralized management environment across server, storage, and networking.

  - Centralized administration and unified user experience in managing stand-alone and clustered storage servers.

- Choice of disk storage and connectivity technologies

  - Direct attached Storage Expansion Node or integrated SAN attached V7000 Storage Node with Fibre Channel and Ethernet connectivity options.

  - Flexibility to deploy integrated unified server or NAS gateway solutions.

- Potentially lower TCO

  - IBM Flex System simplifies management and increases performance and availability, while reducing operational costs.

  - IBM Flex System storage servers are a cost-effective storage consolidation solution in a network environment, enabling centralization of storage and storage management.

  - With Windows Storage Server, no additional licenses are required for users, which can help to significantly reduce Client Access License costs.

- Continuous data availability

  - Failover clustering and load balancing across cluster nodes and multiple redundant network paths ensure continuous data availability.

Solution overview

IBM Flex System NAS solutions with Windows Storage Server 2012 are built with the following components:

- IBM Flex System platform
  - Management
    - IBM Flex System Manager
  - Compute nodes
    - IBM Flex System x240 Compute Node
  - Storage
    - IBM Flex System Storage Expansion Node (used in the unified storage server scenario)
    - IBM Flex System V7000 Storage Node (used in the unified NAS gateway scenario)
  - Networking switches
    - IBM Flex System Fabric EN4093R Scalable Switch
    - IBM Flex System FC3171 8Gb SAN Switch (used in the unified NAS gateway scenario)
- Windows Storage Server 2012

IBM Flex System

IBM Flex System is an integrated platform that delivers custom-tuned, client-specific configurations for optimum flexibility. IBM Flex System combines compute nodes, networking, storage, and management into a complete data center building block that is built for future-proof, heterogeneous data centers with flexibility and open choice of architectures, hypervisors, and environments. IBM Flex System is shown in the following figure.

Figure 2. IBM Flex System

IBM Flex System offers the following capabilities:

- Management

    IBM Flex System Manager is designed to optimize the physical and virtual resources of the IBM Flex System infrastructure while simplifying and automating repetitive tasks. It provides easy system setup procedures with wizards and built-in expertise, and consolidated monitoring for all of your resources, including compute, storage, networking, virtualization, and energy. IBM Flex System Manager provides core management functionality along with automation. It is an ideal solution that allows you to reduce administrative expense and focus your efforts on business innovation.

- Compute nodes

    IBM Flex System offers compute nodes that vary in architecture, dimension, and capabilities. Optimized for efficiency, density, performance, reliability, and security, the portfolio includes the Intel Xeon processor-based and IBM POWER7® processor-based nodes.

    IBM Flex System x240 Compute Node, which is used in the described scenarios, is a half-wide dual-socket compute node built on the Intel Xeon processor E5-2600 product family. Supporting up to 768 GB memory and up to 32 virtual fabric ports, it is optimized for vitualization, high performance, and scalable I/O to run a wide variety of workloads.

- Storage

    The storage capabilities of IBM Flex System give you a choice of dedicated or shared storage with advanced functionality.

    The IBM Flex System Storage Expansion Node is a locally attached storage node that is dedicated and directly attached to a single half-wide compute node. The Storage Expansion Node provides storage capacity for network-attached storage (NAS) workloads, providing flexible storage to match capacity, performance, and reliability needs.

    The IBM Flex System V7000 Storage Node offers robust enterprise-class storage capabilities, which include thin provisioning, automated tiering, internal and external virtualization, clustering, replication, multiprotocol support, and a next-generation graphical user interface (GUI).

- Networking

    A wide range of available adapters and switches to support key network protocols allows you to configure IBM Flex System to fit in your infrastructure. However, you can do so without sacrificing readiness for the future. The networking resources in IBM Flex System are standards-based, flexible, and fully integrated into the system. This combination gives you no-compromise networking for your solution. Network resources are virtualized and managed by workload. These capabilities are automated and optimized to make your network more reliable and simpler to manage.

    The IBM Flex System Fabric EN4093R 10Gb Scalable Switch provides unmatched scalability and performance, while also delivering innovations to help address a number of networking concerns today and providing capabilities that will help you prepare for the future. This switch is capable of supporting up to sixty-four 10 Gb Ethernet connections while offering Layer 2/3 switching and virtualization features like IBM Virtual Fabric and IBM VMready®, and helping clients migrate to a 10 Gb or 40 Gb Ethernet infrastructure.

    The IBM Flex System FC3171 8Gb SAN Switch is a full-fabric Fibre Channel component with expanded functionality. The SAN switch supports high-speed traffic processing for IBM Flex System configurations, and offers scalability in external SAN size and complexity, and enhanced systems management capabilities.

- Enterprise chassis

    The IBM Flex System Enterprise Chassis is the foundation of the offering, supporting intelligent workload deployment and management for maximum business agility. The 14-node, 10U chassis delivers high-performance connectivity for your integrated compute, storage, networking, and management resources. The chassis is designed to support multiple generations of technology, and offers independently scalable resource pools for higher utilization and lower cost per workload.

Windows Storage Server 2012

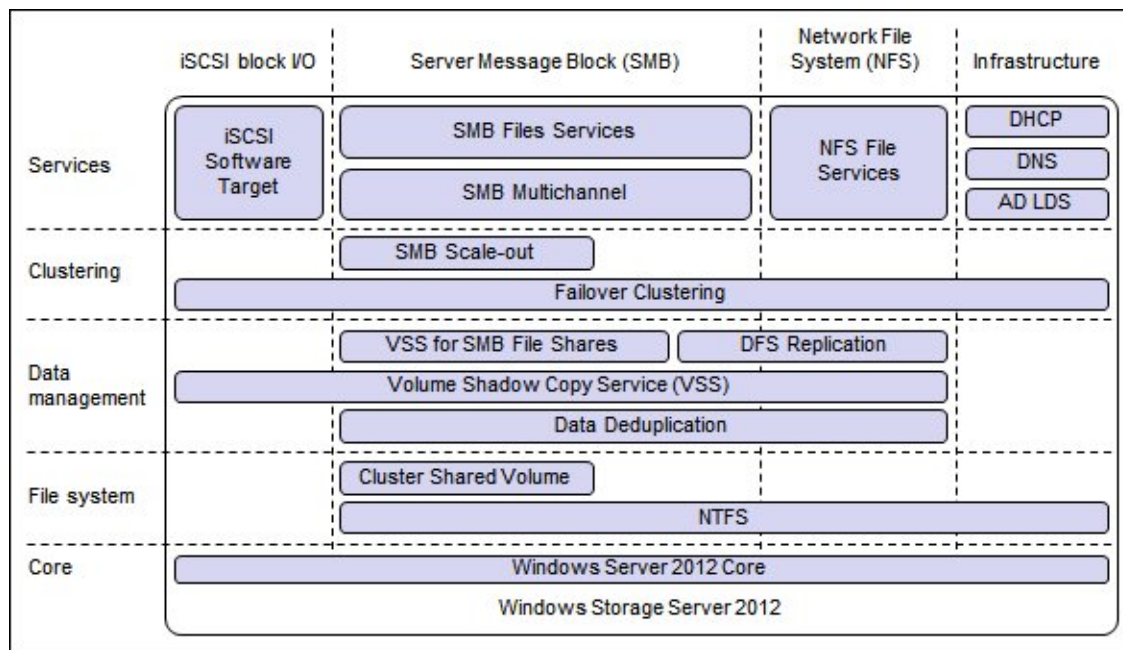The following figure shows the components of Windows Storage Server 2012.

Figure 3. Windows Storage Server 2012 software components

Windows Storage Server 2012 is based on Windows Server 2012 core technologies and is optimized for providing both block- and file-level storage services to the users and server applications.

The components included in Windows Storage Server and the capabilities they provide are as follows:

- Storage protocols
    - iSCSI Software Target offers low-cost shared storage for applications that require block-level access to it.
    - Server Message Block (SMB) File Services provide network shares for the Windows-based user and server application environments.
        - Microsoft SQL Server supports placement of log and data files onto an SMB network share (SQL over SMB).
        - Microsoft Hyper-V supports placement of virtual machine files onto an SMB network share (Hyper-V over SMB).
    - Network File System (NFS) File Services provide network shares for the Linux- or Mac-based user or Linux-based server application environments.
        - VMware vSphere virtual machine files can be placed onto an NFS network share.

- Availability and performance
    - Failover Clustering provides continuous access to the file shares and iSCSI storage.
        - Transparent failover for iSCSI, SMB, and NFS connections.
    - SMB Scale-out takes advantage of Cluster Shared Volume version 2 and offers active/active cluster configuration for the SMB shares by providing simultaneous access to an SMB share from any cluster node.
        - Server applications that can store data onto an SMB file share (such as SQL Server or Hyper-V) can fully utilize increased network bandwidth and load-balancing capabilities of the SMB Scale-out solution.
    - SMB Multichannel allows utilization of multiple redundant network paths between application server SMB clients and SMB file shares hosted on Windows Storage Servers for better throughput while maintaining network availability.
    - Vendor-independent network teaming allows combining of multiple network interfaces into a single fault-tolerant or load-balancing group for better performance and availability.
    - NTFS in Windows Server 2012 improves availability by performing online corruption scanning, utilizing self-healing techniques, and reducing file system repair times.
- Data management
    - Data Deduplication can help to significantly improve the efficiency of storage space utilization.
    - Volume Shadow Copy Service (VSS) for SMB file shares allows performing of backup operations using the snapshots of remote file shares supporting SMB-based server applications (for example, SQL over SMB).
    - DFS Replication provides synchronization capabilities across limited bandwidth network connections in the distributed environments.
    - BranchCache optimizes the usage of WAN links by caching the remote data locally based on predefined policies.
- Infrastructure services
    - Active Directory Lightweight Directory Services (AD LDS)
    - Dynamic Host Configuration Protocol (DHCP)
    - Domain Name Services (DNS)
    - Internet Information Services (IIS)
    - Hyper-V
    - Print and Document Services

Infrastructure services are essential utility services that can be deployed on Windows Storage Server itself, if they are not already present in the network, without the need to buy additional server hardware and operating system software. Windows Storage Server 2012 allows hosting of up to two virtual machines, which can serve different domains.

Windows Storage Server 2012 Standard is fulfilled via the Microsoft Reseller Option Kit (ROK) program. One server license allows Windows Storage Server 2012 to be installed on a single server with up to two processors. An additional server license combined with the initial server license extends the number of sockets to four. Windows Storage Server 2012 does not require client access licenses.

The IBM Reseller Option Kit (ROK) is a software delivery option that enables distributors and resellers to order Microsoft Windows Server separately from IBM server hardware, and then preinstall it on an IBM System x® server before delivering it to the client. ROK uses BIOS-locked media that has been tuned and customized for IBM hardware, allowing for easier installation.

Solution architecture

Typical IBM Flex System NAS deployment scenarios include:

- Unified storage server
- Highly available unified gateway

Unified storage server

In the unified storage server solution, Windows Storage Server 2012 is deployed on an x240 compute node with the Storage Expansion Node. It performs file serving tasks hosting SMB and NFS file shares for Windows-, Linux-, and Mac-based clients, SMB file shares for server applications (SQL over SMB, Hyper-V over SMB, virtual desktop infrastructure), and iSCSI storage targets for the server applications requiring block I/O. Client and server applications utilize IBM Virtual Fabric 10 Gb Ethernet LAN infrastructure.

Data Deduplication service can be enabled on a compute node to allow the most efficient use of the storage space (especially for the software distribution packages, image repositories, and archives). Optionally, if the storage server is a part of the distributed environment, additional services such as DFS replication can be enabled to synchronize the content between the central and remote locations for the purpose of centralized backup operations (from the remote to the central location) and software delivery (from the central to the remote location).

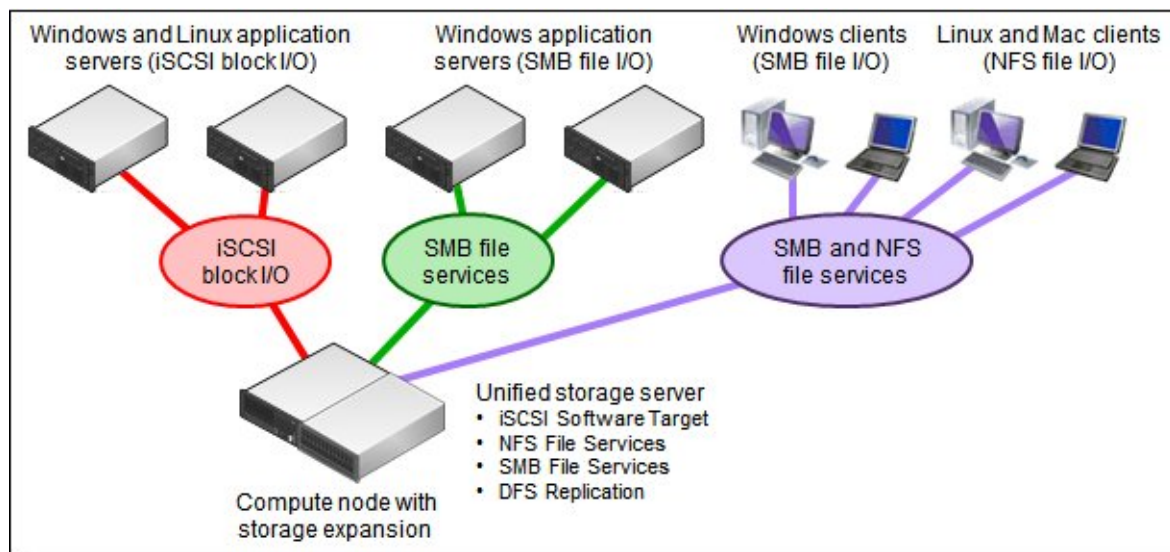The following figure illustrates the unified storage server solution.

Figure 4. IBM Flex System unified storage server solution

For the unified storage server solution, the x240 dual-socket compute node with the storage expansion unit and running Windows Storage Server 2012 Standard is used.

The IBM Flex System x240 Compute Node is a high-performance server that offers outstanding performance for virtualization with new levels of CPU performance and memory capacity, and flexible configuration options. It supports up to two eight-core Intel Xeon processors and high-density memory designs with 24 DIMM slots.

The IBM Flex System Storage Expansion Node is a storage enclosure that attaches to a single half-wide compute node to provide that compute node with additional direct-attach local storage. The Storage Expansion Node provides flexible storage to match capacity, performance, and reliability needs. It supports up to 12 SAS, SATA, and SSD drives protected by advanced RAID functionality and flash-backed cache.

An x240 compute node with the storage expansion node supports solid-state drives, which can be deployed as an HDD cache with the SSD Caching Enabler FoD upgrade available for IBM Flex System RAID controllers, helping to increase the performance of SMB-based IOPS-intensive applications such as SQL Server.

The x240 compute node is equipped with the onboard Emulex 10 Gb Virtual Fabric controller that supports an IBM Virtual Fabric vNIC solution (splitting one 10 Gb port into up to four virtual ports or vNICs) and, together with the EN4093 10Gb Scalable Switch, can provide bidirectional bandwidth allocation and traffic metering on a vNIC level that is based on predefined vNIC bandwidth values.

The IBM Flex System Fabric EN4093R 10Gb Scalable Switch delivers exceptional performance that is both lossless and low latency. In addition, the EN4093R delivers excellent cost savings in terms of acquisition costs and energy costs, particularly considering the feature-rich design when it comes to virtualization, CEE/FCoE, high availability, and its enterprise-class Layer 2 and Layer 3 functionality.

In the described solution, vNIC capabilities can be used to share the 10 Gb bandwidth of the onboard Virtual Fabric port among different groups (iSCSI application servers, SMB application servers, and SMB/NFS clients) while isolating the traffic from these groups and ensuring that application SLAs are met.

The following figure shows the IBM Flex System components used in a unified storage server solution.
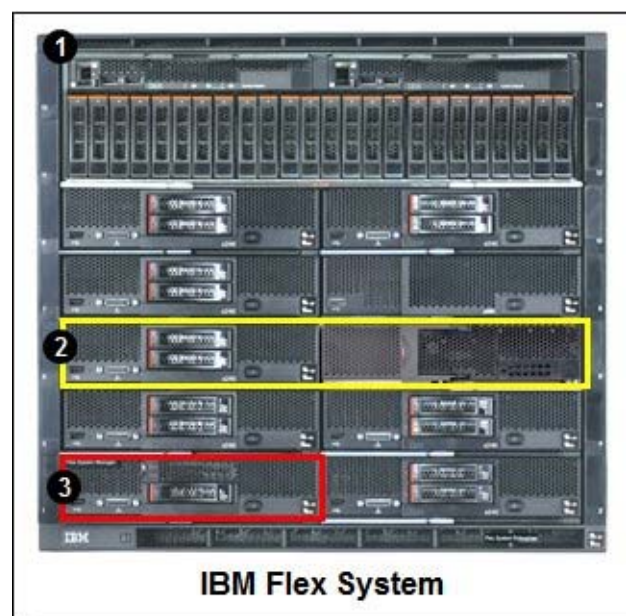

Figure 5. IBM Flex System components in a unified storage server solution

The following table highlights the details of the typical configuration of the IBM Flex System unified storage server solution that is shown in Figure 5.

Table 3. Typical configuration of the IBM Flex System unified storage server solution (Figure 5)

Diagram reference	Description
1	**1x Enterprise Chassis with installed infrastructure components**
	1x Enterprise Chassis with 6x 2500 W power supplies 2x EN4093R 10Gb Scalable Switches and optical SW SFP+ transceivers (not shown in Figure 5) 2x Chassis Management Modules (not shown in Figure 5)
2	**1x x240 Compute Node with the Storage Expansion Node**
	x240 Compute Node: 2x Intel Xeon processor E5-2620 32 GB memory 2x 250 GB NL SATA HDDs in a mirrored pair for the operating system 2x 10 Gb onboard Ethernet ports divided into vNICs for the network connections Storage Expansion Node: 4x 300 GB SAS 2.5-inch HDDs in a RAID-5 for up to 900 GB of usable data storage for the server applications 8x 1 TB SATA 2.5-inch HDDs in a RAID-5 for up to 7 TB of usable data storage for the information workers' data, software distribution packages, image repositories, and archives 1x 1 GB flash-backed cache upgrade
3	**1x IBM Flex System Manager management appliance**

Highly available unified NAS gateway

The IBM Flex System unified NAS gateway solution can help to lower acquisition costs for the server hardware by providing network-based highly available file storage services for the server applications without a need to connect them to Fibre Channel networks.

In the highly available unified gateway solution, Windows Storage Server 2012 is deployed as a failover cluster with two or more compute nodes and the integrated shared Fibre Channel storage system. The high availability cluster performs file serving tasks hosting SMB and NFS file shares for Windows-, Linux-, and Mac-based clients, SMB file shares for server applications (SQL over SMB, Hyper-V over SMB, virtual desktop infrastructure), and iSCSI storage targets for the server applications requiring block I/O.

Client and server applications utilize cost-efficient redundant IBM Virtual Fabric 10 Gb LAN infrastructure. SMB Scale-out and SMB Multichannel provide performance improvement for the SMB I/O server applications with load balancing across cluster nodes and redundant network links.

Data Deduplication service can be enabled on a server to allow the most efficient use of the storage space (especially for the software distribution packages, image repositories, and archives). Optionally, if the cluster is a part of the distributed environment, additional services such as DFS replication can be enabled to synchronize the content between the central and remote locations for the purpose of centralized backup operations (from the remote to the central location) and software delivery (from the central to the remote location).

The following figure illustrates the highly available unified NAS gateway solution.
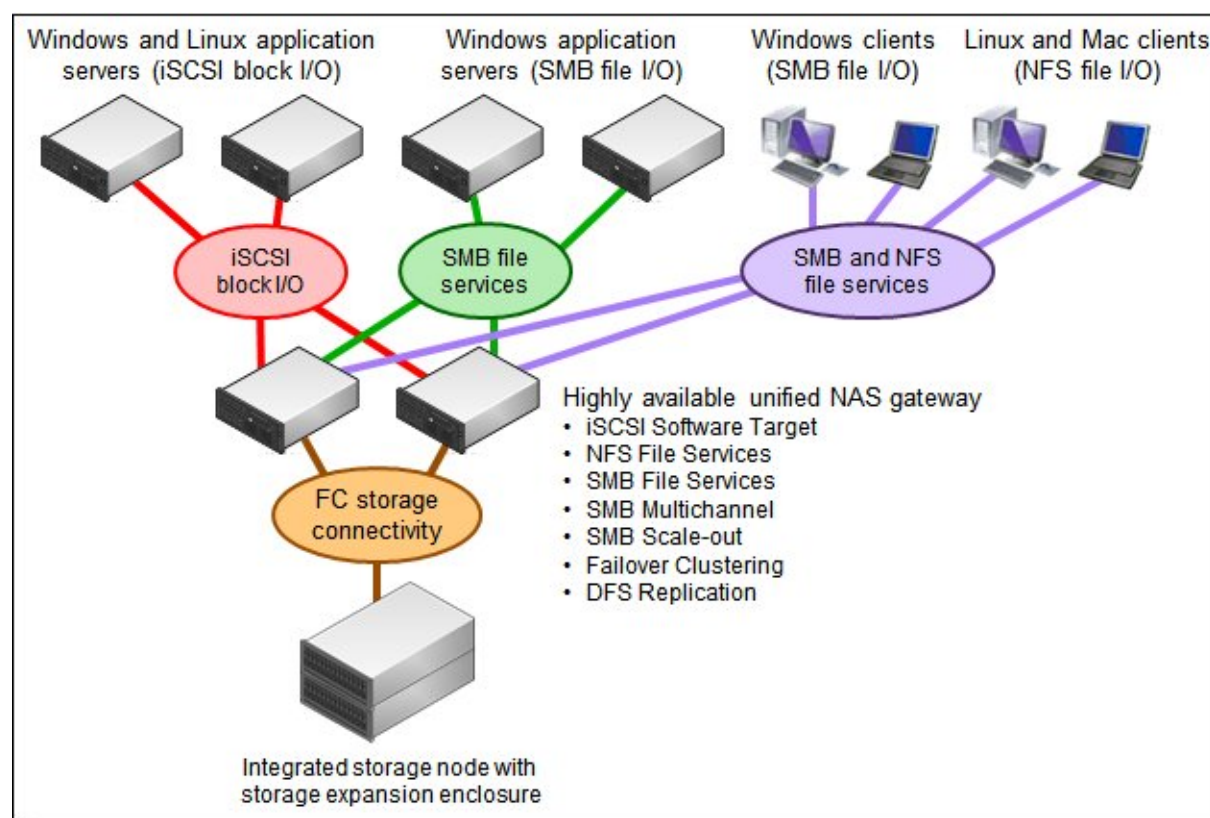

Figure 6. Highly available unified NAS gateway solution

For the highly available unified NAS gateway solution, two or more x240 compute nodes running Windows Storage Server 2012 Standard are used. They are connected to the IBM Flex System V7000 Storage Node integrated shared storage system using the Fibre Channel fabric.

The IBM Flex System x240 Compute Node is a high-performance server that offers outstanding performance for virtualization with new levels of CPU performance and memory capacity, and flexible configuration options. It supports up to two eight-core Intel Xeon processors and high-density memory designs with 24 DIMM slots.

The IBM Flex System V7000 Storage Node offers robust enterprise-class storage capabilities, which include thin provisioning, IBM Easy Tier® automated tiering, internal and external virtualization, clustering, replication, multiprotocol support, and a next-generation graphical user interface (GUI). It supports Fibre Channel, iSCSI, and FCoE connectivity, and scales up to 240 SAS and NL SAS HDDs and SSDs with the optional storage expansion enclosures.

The x240 compute node is equipped with the onboard Emulex 10 Gb Virtual Fabric controller that supports an IBM Virtual Fabric vNIC solution (splitting one 10 Gb port into up to four virtual ports or vNICs) and, together with the EN4093 10Gb Scalable Switch, can provide bidirectional bandwidth allocation and traffic metering on a vNIC level that is based on predefined vNIC bandwidth values.

The IBM Flex System Fabric EN4093R 10Gb Scalable Switch delivers exceptional performance that is both lossless and low latency. In addition, the EN4093R delivers excellent cost savings in terms of acquisition costs and energy costs, particularly considering the feature-rich design when it comes to virtualization, CEE/FCoE, high availability, and its enterprise-class Layer 2 and Layer 3 functionality.

In the described solution, vNIC capabilities can be used to share the 10 Gb bandwidth of the onboard Virtual Fabric port among different groups (iSCSI application servers, SMB application servers, and SMB/NFS clients) while isolating the traffic from these groups and ensuring that application SLAs are met.

The IBM Flex System FC3171 8Gb SAN Switch is a full-fabric Fibre Channel component with expanded functionality. The SAN switch supports high-speed traffic processing for IBM Flex System configurations, and offers scalability in external SAN size and complexity, and enhanced systems management capabilities.

The following figure shows the IBM Flex System components in a highly available unified gateway solution.
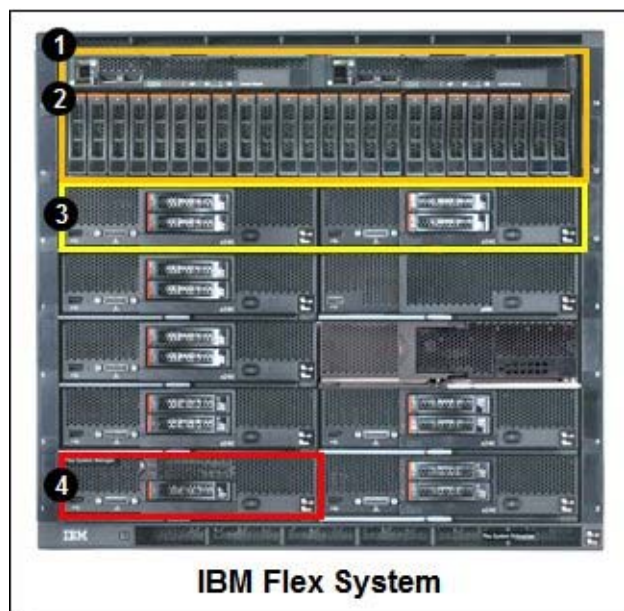

Figure 7. IBM Flex System components in a highly available unified gateway solution

The following table highlights the details of the typical configuration of the IBM Flex System unified NAS gateway solution that is shown in Figure 7.

Table 4. Typical configuration of the IBM Flex System unified NAS gateway solution

Diagram reference	Description
1	**1x Enterprise Chassis with installed infrastructure components**
	1x Enterprise Chassis with 6x 2500 W power supplies 2x EN4093R 10Gb Scalable Switches and optical SW SFP+ transceivers (not shown in Figure 7) 2x FC3171 8Gb SAN Switches and optical SW SFP+ transceivers (not shown in Figure 7) 2x Chassis Management Modules (not shown in Figure 7)
2	**1x V7000 integrated shared storage**
	2x 8 Gb Fibre Channel 4-port cards 6x 300 GB 10K rpm SAS 2.5-inch HDDs in a RAID-5 for up to 1.5 TB of usable data storage for the server applications 6x 146 GB 15K rpm SAS 2.5-inch HDDs in a RAID-5 for up to 730 GB of usable data storage for the high-performance server applications 12x 1 TB NL SAS 2.5-inch drives in a RAID-5 for up to 11 TB of the usable data storage for the information workers data, software distribution packages, image repositories, and archives
3	**2x x240 compute nodes**
	2x Intel Xeon processor E5-2680 48 GB memory 2x 250 GB NL SATA HDDs in a mirrored pair for the operating system 2x 10 Gb onboard Ethernet ports divided into vNICs for the network connections 1x FC3172 2-port 8Gb FC adapter for the integrated storage connections
4	**1x IBM Flex System Manager management appliance**

Ordering information

This section contains ordering information for the IBM Flex System NAS solutions.

IBM Flex System unified storage server solution

The following table shows ordering information for the components of the IBM Flex System unified storage server solution in a typical configuration.

Table 4. Ordering information for the IBM Flex System unified storage server solution

Part number	Description	Quantity
Chassis		
8721A1x*	IBM Flex System Enterprise Chassis with 2x2500W PSU, Rackable	1
43W9049	IBM Flex System Enterprise Chassis 2500W Power Module	4
95Y3309	IBM Flex System Fabric EN4093R 10Gb Scalable Switch	2
68Y7030	IBM Flex System Chassis Management Module	1
46C3447	IBM SFP+ SR Transceiver	4
43W9078	IBM Flex System Enterprise Chassis 80mm Fan Module Pair	2
39Y7916	2.5m IEC 309 C19 to C20 intra rack cable	6
Management		
8731A1x*	IBM Flex System Manager Node	1
90Y4222	IBM Flex System Manager w/3 Yr S&S	1
Compute nodes		
8737F2x*	IBM Flex System x240 Compute Node, Xeon 6C E5-2620 95W 2.0GHz/1333MHz/15MB, 2x4GB, O/Bay 2.5in SAS	1
81Y5183	Intel Xeon Processor E5-2620 6C 2.0GHz 15MB Cache 1333MHz 95W	1
49Y1406	4GB (1x4GB, 1Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333MHz LP RDIMM	6
81Y9722	IBM 250GB 7.2K 6Gbps NL SATA 2.5" SFF HS HDD	2
68Y8588	IBM Flex System Storage Expansion Node	1
90Y8877	IBM 300GB 10K 6Gbps SAS 2.5" SFF G2HS HDD	4
81Y4559	ServeRAID M5100 Series 1GB Flash/RAID 5 Upgrade for IBM System x	1
81Y9730	IBM 1TB 7.2K 6Gbps NL SATA 2.5" SFF HS HDD	8
Windows Storage Server 2012		
00Y6302	Windows Storage Server 2012 Standard (2 CPU) - English ROK	1

* x in the Part number represents a country-specific letter (for example, the EMEA part number is 8721A1G, and the US part number is 8721A1U). Ask a local IBM representative for specifics.

IBM Flex System unified NAS gateway solution

The following table shows ordering information for the components of the IBM Flex System highly available unified NAS gateway solution in a typical configuration.

Table 4. Ordering information for the IBM Flex System unified NAS gateway solution

Part number	Description	Quantity
Chassis		
8721A1x*	IBM Flex System Enterprise Chassis with 2x2500W PSU, Rackable	1
43W9049	IBM Flex System Enterprise Chassis 2500W Power Module	4
95Y3309	IBM Flex System Fabric EN4093R 10Gb Scalable Switch	2
69Y1930	IBM Flex System FC3171 8Gb SAN Switch	2
68Y7030	IBM Flex System Chassis Management Module	1
44X1964	IBM 8 Gb SFP+ SW Optic Transceiver	4
46C3447	IBM SFP+ SR Transceiver	4
43W9078	IBM Flex System Enterprise Chassis 80mm Fan Module Pair	2
39Y7916	2.5m IEC 309 C19 to C20 intra rack cable	6
Management		
8731A1x*	IBM Flex System Manager Node	1
90Y4222	IBM Flex System Manager w/3 Yr S&S	1
Compute nodes		
8737F2x*	IBM Flex System x240 Compute Node, Xeon 6C E5-2620 95W 2.0GHz/1333MHz/15MB, 2x4GB, O/Bay 2.5in SAS	2
81Y5183	Intel Xeon Processor E5-2620 6C 2.0GHz 15MB Cache 1333MHz 95W	2
49Y1406	4GB (1x4GB, 1Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333MHz LP RDIMM	20
81Y9722	IBM 250GB 7.2K 6Gbps NL SATA 2.5" SFF HS HDD	4
69Y1938	IBM Flex System FC3172 2-port 8Gb FC Adapter	2
Integrated shared storage		
4939H49	IBM Flex System V7000 Control Enclosure	1
90Y7647	300 GB 10,000 RPM 6Gbps 2.5-inch SAS HDD	6
90Y7662	146 GB 15,000 RPM 6Gbps 2.5-inch SAS HDD	6
90Y7642	1 TB 7,200 RPM 6Gbs 2.5-inch NL SAS HDD	12
90Y7684	8Gb Fibre Channel 4 Port Daughter Card	2
Windows Storage Server 2012		
00Y6302	Windows Storage Server 2012 Standard (2 CPU) - English ROK	2

* x in the Part number represents a country-specific letter (for example, the EMEA part number is 8721A1G, and the US part number is 8721A1U). Ask a local IBM representative for specifics.

Related information

For more information, see the following documents:

- IBM Flex System product page
  http://ibm.com/systems/flex

- IBM Flex System Information Center
  http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp

- IBM ServerProven® hardware compatibility page for IBM Flex System
  http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/

- *IBM Flex System x240 Compute Node*, IBM Redbooks Product Guide
  http://www.redbooks.ibm.com/abstracts/tips0860.html

- *IBM Flex System Storage Expansion Node*, IBM Redbooks Product Guide
  http://www.redbooks.ibm.com/abstracts/tips0914.html

- *IBM Flex System Manager*, IBM Redbooks Product Guide
  http://www.redbooks.ibm.com/abstracts/tips0862.html

- *IBM Flex System Fabric EN4093R 10Gb Scalable Switch*, IBM Redbooks Product Guide
  http://www.redbooks.ibm.com/abstracts/tips0864.html

- *IBM Flex System FC3171 8Gb SAN Switch*, IBM Redbooks Product Guide
  http://www.redbooks.ibm.com/abstracts/tips0866.html

- *IBM Flex System Enterprise Chassis*, IBM Redbooks Product Guide
  http://www.redbooks.ibm.com/abstracts/tips0863.html

- *IBM PureFlex™ System and IBM Flex System Products and Technology,* an IBM Redbooks publication
  http://www.redbooks.ibm.com/abstracts/sg247984.html

- IBM Flex System V7000 Storage Node product page
  http://www.ibm.com/systems/storage/disk/storwize_v3700/index.html

- IBM announcement letters and sales manuals
  http://www.ibm.com/common/ssi/index.wss?request_locale=en
  On this page, enter the product name. On the next page, narrow your search results by information type, geography, language, or all three options.

- *Configuration and Option Guide*
  http://www.ibm.com/systems/xbc/cog/

- xREF - IBM System x Reference Sheets
  http://www.redbooks.ibm.com/xref

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